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DECLARATION OF TRANSLATOR

I, Lawrence B. Hanlon, of the International Translation Center, Inc., do hereby avow and declare that I am conversant with the English and German languages and am a competent translator of German into English. I declare further that to the best of my knowledge and belief the following is a true and correct English translation prepared and reviewed by me of the document in the German language attached hereto.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of any patent issued thereon.

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Date: 08/14/2006

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Hook and Loop Connector Piece

The invention relates to hook and loop connector piece comprising a support strip with hooking elements located on it on one side and with at least one cover strip which forms at least one free side edge area which extends beyond the assignable longitudinal edge of the support strip, and the respective free side edge area of the respective cover strip in the direction to the support strip can be folded over itself along a fold line running in the longitudinal direction, such that the end edge of the respective free side edge area of the cover strip is facing the assignable longitudinal edge of the support strip, on the side of the hook and loop connector piece facing away from the hooking elements there being a connecting means for mold foam.

Hook and loop connector pieces of this type, in which a plurality of hooking elements made in one piece in the form of stalks which have thickenings is located on the hooking or front side of the support strip, are conventional. A production process for producing the support strip of these hook and loop connector pieces is described in DE 198 28 856 C1. In this process preferably a thermoplastic, especially polyolefin or polyamide, in the plastic or liquid state is supplied to the gap between the pressing tool and the molding tool, the shaping element on the molding tool being a screen with continuous cavities and the hooking elements being formed by the thermoplastic which at least partially hardens in the cavities of the screen. In this way a so-called micro-hook and loop

fastener with 200 to 400 hooking elements per cm^2 is formed. Instead of the mushroom-like hook and loop elements formed in this connection, a support strip can also be provided in the form of a textile material in which the hooking elements are formed by a loop material which is for example integral with the textile support strip. Instead of the loop material, however, a fleece or mushroom structure can also be used.

These hook and loop connector pieces are used for diverse purposes, for example in motor vehicle engineering, floor installation technology, clothing of any type, and for special applications in mechanical engineering. The hook and loop connector pieces have proven themselves in these areas as a detachable and reliable connecting and closing technology. If these hook and loop connector pieces are used for aircraft or vehicle passenger seats, they are used among other purposes to attach seat coverings to foam body parts, ones consisting of a mold foam, some hook and loop connector pieces being foamed into the cushion foam material when the respective seat is being produced, and the hook and loop connector piece with the corresponding hooking elements being fastened to the upholstery material, in particular sewn to it. For the purpose of producing the foam body parts, the hook and loop connector pieces are inserted into so-called seating pipes of a foam mold, and by insertion of foam material into the free cross sections of the foam mold, preferably polyurethane (PU) foam, the hook and loop connector pieces are fastened to the foam body parts in the process of foaming-in. The parts employed normally project above the other walls of the foam mold and thus later form groove-like recesses in the foam body part which is then engaged in the upholstery material with the other corresponding hook and loop connector piece. In this way geometric seam and shape patterns may be produced on a particular seat depending on the design.

DE-A-100 39 940 discloses a generic hook and loop connector piece with a support strip with hooking elements located on it and with a cover strip which covers the support strip on the side facing away from the hooking elements, said cover strip being wider than the support strip, so that free side edge areas of the cover strip extend on both sides beyond the assigned longitudinal edges

of the support strip. Because in the known solution the two free side edge areas of the cover strip are folded around one another such that the end edges of the free side edge areas are facing the longitudinal edges of the support strip, the cover strip on both sides forms a kind of sealing lip which extends along the area having the hooking elements and adjoins the wall parts of the foam mold which surround the mold trough in which the hooking elements are held during the foaming process. The foam material introduced into the foam mold causes this sealing lip to be pressed against the facing wall parts of the mold, the sealing lip due to a certain flexibility in the area of the fold line conforming to the wall areas which form the sealing surfaces, so that the improvement desired of in the sealing action of the foam barriers is achieved.

Moreover, in the known solution the support strip can have at least one flexurally stiff reinforcing element which extends preferably in the form of a bending wire along the support strip. In foam molding therefore better embedding properties for hook and loop connector pieces result and due to the flexural stiffness of the reinforcing element the hook and loop connector pieces, once inserted in the respective foam mold, remain in their position.

Furthermore, in the known solution the cover strip is formed from a plastic nonwoven in order to enable in such a way good crosslinking with the polyurethane mold foam for producing cushion parts in motor vehicle seats. But it has been found that especially under subsequent high stress in daily use of the seat this adhesion is often not adequate and detachment of the hook and loop connector piece from the foam cannot be precluded.

In order to counteract this, it has already been proposed in the prior art (US 4,693,921) that anchor elements be attached on the back of the support strip with the hooking elements, with projecting anchor parts in order to improve adhesion to the mold foam. But it has been shown in practice that in spite of these anchor elements improved adhesion of the foam to the hook and loop connector piece does not occur; on the contrary, often during the foaming-in process, the anchor

elements prevent the foam material from flowing freely by the anchor elements, with the result that in the area of the anchor elements air holes occur in the foam, that is to say, cavities which in turn unintentionally promote the separation of the hook and loop connector piece and mold foam.

On the basis of this prior art, therefore the object of the invention is to further improve the known solutions such that a reliable foam barrier is ensured by the respective side edge area of the cover strip and that moreover optimum adherence of the mold foam to the hook and loop connector piece occurs. This object is achieved by a hook and loop connector piece with the features specified in claim 1 in its entirety.

In that, as specified in the characterizing part of claim 1, the connecting means is formed from a plurality of individual projecting rods, which free of additional projections effect adherence of the mold foam such that the anchor elements with their projecting anchor parts are replaced by pin-like individual rods with a smooth surface which for this purpose are made free of projections. It is surprising to one with average skill in the art in the field of hook and loop fastener technology that with less use of material, in this instance formed by the individual rods, he arrives at better adhesion results than in the known anchor elements or with the known nonwoven material of the cover strip.

The individual rods on the side of the hook and loop connector piece facing away from the hooking elements form only a small resistance to inflow of mold foam, so that the foam material can flow unhindered to the individual rods and can completely encompass them without air holes or other cavities forming. By totally surrounding the individual rods with the mold foam, adhesion over a large surface is implemented, with it being possible to made the individual rods microscopically small and still reliable adhesion being achieved compared to anchor elements which often have at least the size of the hooking elements on the opposing site or are made still larger in order to be able to engage the mold foam material as deeply as possible. In this respect the solution as claimed in the invention is implemented in a space-saving manner.

Moreover, as a result of the folded-over side edge areas, reliable sealing in the foam mold (pipe) is achieved and the hooking elements necessary later for operation of the hook and loop connector piece are not rendered unusable by the mold foam.

In one preferred embodiment of the hook and loop connector piece as claimed in the invention, each individual rod has a cylindrical middle part which undergoes transition on the head side into a convexly made head part and ends on the foot side via a concavely made foot part in a strip-like support part and is connected integrally to it. By changing from convex shaping to concave with incorporation of a cylindrical middle part, an ideal adhesion geometry is achieved; this has been shown by practical tests. The strip-like support part can also be formed in order to bring about a so-called back-to-back solution by the support strip of the hook and loop connector piece itself, the respective cover strip with its side edge areas then having to act along the longitudinal edges of the support strip.

Other advantageous embodiments are the subject matter of the other dependent claims.

In the following, one embodiment of the hook and loop connector piece as claimed in the invention will be detailed using the drawings. The figures are schematic and not to scale.

FIG. 1 shows a cutaway view of a seating pipe for a foam mold, a hook and loop connector piece being inserted into the mold trough of the seating pipe (shown partially in a section, partially in a front view);

FIG. 2 shows a top view of the hook and loop connector piece, viewed in the direction of looking at its front side which has hooking elements;

FIG. 3 shows a side view of a single individual rod as part of the connecting means;

FIG. 4 shows another top view of the hook and loop connector piece, viewed in the direction of looking at its back facing away from the hooking elements.

The hook and loop connector piece as claimed in the invention has a support strip 10. On one side of the support strip 10 there are hooking elements 12 located in a row next to one another and in succession, the hooking elements 12 as shown in FIG. 2 viewed toward the longitudinal direction of the support strip 10 being located in obliquely running longitudinal and transverse rows. For example, the hook and loop connector piece can be a so-called microfastener in which 200 to 400 hooking elements and more per cm^2 are provided on a support strip 10 with a thickness from 0.1 to 0.3 mm. A process for producing the support strip of such a microfastener is disclosed in DE 198 28 856 C1. In this known process by preference a thermoplastic is supplied to the gap between the pressing tool and the molding tool, in which the shaping element is a screen which has continuous cavities and in which the hooking elements are formed by the plastic which at least partially hardens in the cavities of the screen.

The support strip 10 has a bending-resistant stiffening profile which extends along the entire length of the support strip 10. In the illustrated embodiment this stiffening profile consists of a wire 16, especially in the form of a metal wire. The wire 16 is permanently connected via an adhesive means designated as a whole as 18 to the support strip 10 on its back facing away from the hooking elements 12. The adhesive can consist for example of a moisture-crosslinking PU. The adhesive 18 completely covers one side of the support strip 10 and is permanently connected to it. The diameter ratios are selected such that the thickness of the adhesive 18 corresponds to the thickness of the wire 16. But it would also be conceivable for the adhesive 18 in terms of its thickness to only partially accommodate the wire 16 with its given diameter.

The adhesive 18 on its side facing away from the support strip 10 has a cover strip 20, preferably in the form of a textile or plastic nonwoven. The cover strip 20 projects laterally along the longitudinal edges 33 of the support strip 10 by a definable distance, i.e., on both sides of the support strip 10, one respective free side edge area 21 each being formed with the cover strip 20, this free side edge area 21 being designed to rest against the wall part 22 on the top of the seating pipe 24 which is a component of the foam mold not shown in FIG. 1. The seating pipe 24 has a mold trough in the form of a recess 28, its free cross section being matched to the support strip 10 of the hook and loop connector piece to be accommodated in this mold trough with its hooking elements 12 in the form of hooking mushrooms. The hooking elements 12 generally make contact with the base of the recess 28 on the front side.

The free side edge areas 21 of the cover strip 20, as is apparent from FIG. 1, are folded over themselves in the direction to the front side featuring the hooking elements 12, i.e., toward the side facing the seating pipe 24, the fold lines 20 each extending in the longitudinal direction of the cover strip 10 and in the illustrated embodiment being flush with the side walls 35 of the seating pipe 24. In the hook and loop connector piece pressed against the seating pipe 24, as is shown in FIG. 1, therefore the cover strip 20 rests on the wall parts 22 which laterally delimit the mold trough or recess 28, with a double material layer. This double layer of the folded cover strip 20 acts like a sealing lip which prevents penetration of foam material into the recess 28 in the foaming process, i.e., when the foaming mold is filled with foam material; this is additionally promoted by the nonwoven-like configuration so that the hooking elements 12 of the support strip 10 which are held in the recess 28 are protected against the danger of being cemented by the penetrating foam material and consequently becoming unusable.

Along the wall parts 22 of the seating pipe 24 there are permanent magnet strips 30 or a row of individual permanent magnets which together with the ferromagnetic property of the cover strip 20 form a magnetic holding means by which the folded side edge areas 21 of the cover strip 20 and

thus of the hook and loop connector piece are secured on the seating pipe 24. In particular, the cover strip 20 which by preference is formed from a nonwoven acquires its ferromagnetic property by embedding ferromagnetic particles in the material of the cover strip 20. The use of a nonwoven as the cover strip 20 enables good sealing action relative to the polyurethane mold foam which is placed in the foam mold for producing cushion parts for vehicle seats, including aircraft passenger seats, so that it is ensured that the hook and loop connector pieces are reliably anchored by foaming in on the cushion part for their later use and connection to the covering material of a seat.

On the side of the hook and loop connector piece facing away from the hooking elements 12 there is a connecting means 36 for the mold foam. The strip-like connecting means 36 consists of a plurality of projecting individuals rods 38, of which one is shown enlarged in FIG. 3. These individual rods 38 permit adhesion of the mold foam to the actual hook and loop connector piece without projections, that is, without projecting anchor elements. The individual rods 38 can be produced analogously to the screen technology described in DE 198 28 856 C2 for producing hooking elements 12, however the respective shaping cavity of the screen not being completely filled with the plastic material, so that before reaching the bottom of the mold the plastic material is already starting to harden, so that the individual rods 38 on their free end do not acquire the head configuration, as are characteristic for the hooking elements 12 as a mushroom closure part. In terms of their external shape the individual rods 38 relative to their middle part therefore are similar to the stalks of the hooking elements 12 connected to the head parts toward the free end. Furthermore, the individual rods 38 are an integral part of the strip-like connecting means 36 of plastic material. A suitable adhesive is used to produce the connection between the connecting means 36 and the back of the cover strip 20.

The connecting means 36 in contrast to FIGS. 1 and 4 need not extend over the entire width of the cover strip 20; optionally here only partial extension (not shown) is sufficient. Furthermore, in order to bring about a back-to-back configuration, the individual rods 38 could also be configured

on the back of the support strip 20 with the hooking elements 12, and then the cover areas (respective free side edge area 21) would have to be connected along the longitudinal edges 33 of the support strip 10 (not shown).

As shown especially enlarged by FIG. 3, each individual rod 30 has a cylindrical middle part 40 which undergoes transition on the head side into a convexly shaped head part 42 and on the foot side ends in a strip-like support part 46 as a component of the connecting means 36 by way of a concavely shaped foot part. As furthermore follows from FIG. 4, the individual rods 38 are located in longitudinal rows 48 and transverse rows 50. In this way a type of checkerboard pattern is formed and at the connecting points between the longitudinal rows 48 and the transverse rows 50 there is one respective individual rod 38 each. In this respect FIG. 4 shows that the distances between the adjacent individual rods 38 from the longitudinal row 48 and the assignable transverse row 50 are essentially the same. The distances between adjacently opposite individual rods are 400 to 700 µm, preferably roughly 600 µm. The diameter of the middle part 40 is roughly 200 µm, the size ratios with scale X being illustrated which in FIG. 3 at top left shows a length ratio of roughly 200 µm. The height of each individual rod 38 is approx. 400 µm and the total height of the support part 46 with the individual rods 38 seated is approx. 600 µm.

In order to be able to achieve better adhesion of the individual rods 38 to the mold foam, provision may be made such that the individual rods 38 be provided at least partially with a coating which improves the adhesion or adherence of the foam. This coating can have a gradient action such that the mold foam is pulled toward the individual rods 38 and immediately hardens there. Using suitable methods the surface energy of the plastic material can be increased, by means of plasma processes, corona processes and gas fluorination processes.